DEVELOPMENT OF POLYHERBAL VETERINARY GALACTAGOGUE FORMULATIONS AND STUDY OF ITS EFFECT ON MILK YIELD AND QUALITY

A
Synopsis

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INTRODUCTION

Livestock play very significant role in the human civilization. It provides 50% of the total value of agricultural output globally. About 67% population of India resides in rural areas and their livelihood is mainly based on agriculture and animal husbandry. Agriculture along with animal husbandry is very essential aspects of Indian economy (Mitra and Mukherjee, 2007; Shrivastava*et al*., 2017). India is one of the major dairying countries in the world with a livestock population over 535.78 million. Total Bovine livestock population in India is 302.79 million which produces 176.4 million ton of milk annually. Uttar-Pradesh is the highest livestock population and milk producing state of India with the contribution of 16.8% in total milk production of the country (NDDB, 2019). Optimal milk production is the key requirement in the management of dairy economics. India is the world's largest milk producer but the milk productivity in India is lower than western countries (Morya*et. al.,* 2018). This lower productivity can be attributed to many factors like genetic, environmental, nutritional, poor management practices etc. (Sharma, 1996). To overcome this problem various synthetic, natural and endogenous galactogogues have been tried with variable results by various researchers (Bhatt *et al*., 2009; Patel et al., 2013; Sanghai*et al*., 2017; Prayitno*et al*., 2019). Galactagogue are substances that aid in initiating, maintaining, and augmenting of adequate milk production (Mohanti*et al.,* 2014). Commercially available synthetic galactogogues induce adverse effect on normal health status of the lactating animals. There is growing interest in herbal resources throughout the globe, due to various factors like easy availability, low-cost, little or negligible side effect etc. Herbal galactogogues may leave very little or negligible residues in milk. Phytochemical and pharmacological research on these natural products can contribute forthe discovery of new active compounds with novel structures which may serve as a lead for the development of new galactagogue compounds.

Keeping above view in mind present study is proposed to explore locally available medicinal plants for the development of new poly-herbal galactagogue formulation to enhance lactation and quality of milk in lactating animal.

REVIEW OF LITERATURE

Medicinal plants are used for the healthcare management of animals and human being from time immemorial. Perhaps ancient human societies learned the ethno-veterinary knowledge from animals.

Even today many animals utilize plant secondary compounds or other non-nutritional substances to medicate themselves (Huffman, 1997). The earliest record of veterinary ailments, diagnosis and method of treatment by herbal medicines is found in Ayurveda. Shalihotra is considered to be the first known veterinary doctor in the world lived around 2350 BC in Northern India (Somvanshi, 2006).

Medicinal plants played the most important role in veterinary healthcare management practices throughout the world till 19th century. During 20th century the introductions of modern veterinary facilities like mass vaccination, use of insecticides, antibiotics and anthelmintic etc. make the traditional veterinary medicines non-conventional method in veterinary healthcare management system (Mathias, 2004). At present the choice of animal keepers is neither conventional non-conventional but combination of both veterinary healthcare practices (McCorkle, 1996).

As for as ethno veterinary medicines in modern times is concerned some important contribution were made in various parts of the world by various researchers like Nwude and Ibrahim, 1980; Okolo and Unaigwe, 1984; Shittu and Bwala, 1988; Perzgroveis, 1990; Kato *et al*., 2000; Alwa *et al*., 2002; Viegi *et al.,* 2003; Fajimi and Taiwo, 2005; Iqbal *et al.,* 2005; Froemming, 2006; Yineger *et al*., 2007; McGaw and Eloff, 2008; RaihanDilshad *et al*., 2008; Grade *et al*., 2009; Acharya and Acharya, 2010; Akerreta *et al.,* 2010; Offiah *et al*., 2011; Song and Kim, 2011; Benitez *et al.,* 2012; Rastogi *et al.,* 2015; Singh *et al.,* 2018; Mertenat *et al*., 2019; Aziz *et al.,* 2020; Greene *et al.,* 2020 etc.

As for as the study of ethnoveterinary research in India is concerned some important contributions were made by Sebastain, 1984; Sharma and Singh, 1986; 89; Sudarshan *et al*., 1995; Sharma, 1996; Reddy *et al.,* 1998, Pandey *et al*., 1999, Reddy and Raju, 1999, Jain and Srivastava, 2003; Bisht *et al*., 2004; Takhar and Chaudhary, 2004; Bandopadhyaya and Mukharji, 2005; Kumar *et al*., 2005; Jadeja *et al.,* 2006; Pandey, 2006; Kiruba *et al.,* 2006; Mitra and Mukherjee, 2007; Santhankrishnan *et al*., 2008, Shah *et al*., 2008; Ganesan *et al*., 2008; Bhatt *et al*., 2009; Bharti and Sharma, 2010, Dey and De, 2010; Mishra, 2011; Salve *et al*., 2011; Kumar *et al.,* 2012; Sharma *et al.,* 2012; Kumar and Bharti, 2013; Dandotia *et al*., 2013; Patel *et al.,* 2013; Kumar *et al.,* 2014; Rajkumari *et al*., 2014; Jaikumar *et al.,* 2017; Monteban *et al.,* 2017; Prayitno *et al.,* 2019; Nimbalkar *et al.,* 2020 etc.

As for as the study of ethno galactogogues in Uttar Pradesh is concerned; to the best of our knowledge no study in the farm of research article is conducted to identify and document the medicinal plants and

associated knowledge related to ethno galactagogue among the farmers of Uttar Pradesh. However, Knowledge of herbalgalactagogue is scattered in various ethno veterinary studies conducted by various researchers mentioned above.

As for as the effect of herbal galactogogues on milk yield is concerned some studies have been conducted by Bhatt *et al*., 2009; Patel *et al.*, 2013; Sanghai *et al*., 2017; Prayitno *et al*. 2019, whereas; to the best of our knowledge no study is conducted to evaluate the effect of herbal galactogogues on the milk quality in lactating animals.

AIMS AND OBJECTIVES

Objectives of present study are as under

- Identification of plant species used as veterinary galactagogue for domestic animals in Uttar Pradesh by literature survey
- Identification of plant species used as veterinary galactagogue for domestic animals and related folk claims among the farmers of Agra district by field survey
- Development of new poly-herbal galactagogue formulations for domestic animals with the help of locally available medicinal plants identified on the basis of literature and field survey
- Study of effect of developed poly-herbal galactagogue formulations on the milk yield and quality in domestic animals
- Toxicity evaluation of milk

MATERIALS AND METHODOLOGY

The work plan and methodology of present study will be as under

1. Identification of plant species used as veterinary galactagogue for domestic animals in Uttar Pradesh by literature survey
2. Identification of plant species used as veterinary galactagogue for domestic animals and related folk claims among the farmers of Agra district by field survey.
3. Development of veterinary poly-herbal galactagogue formulations with the help of locally available medicinal plants identified on the basis of literature and field survey
4. Study of effect of developed poly herbal galactagogue formulations on milk yield and quality
5. Selection of best formulation on the basis of milk yield and quality.

6. Toxicity evaluation of milk produced after giving polyherbal galactagogue formulations.

Detail methodology for every objective is described as under

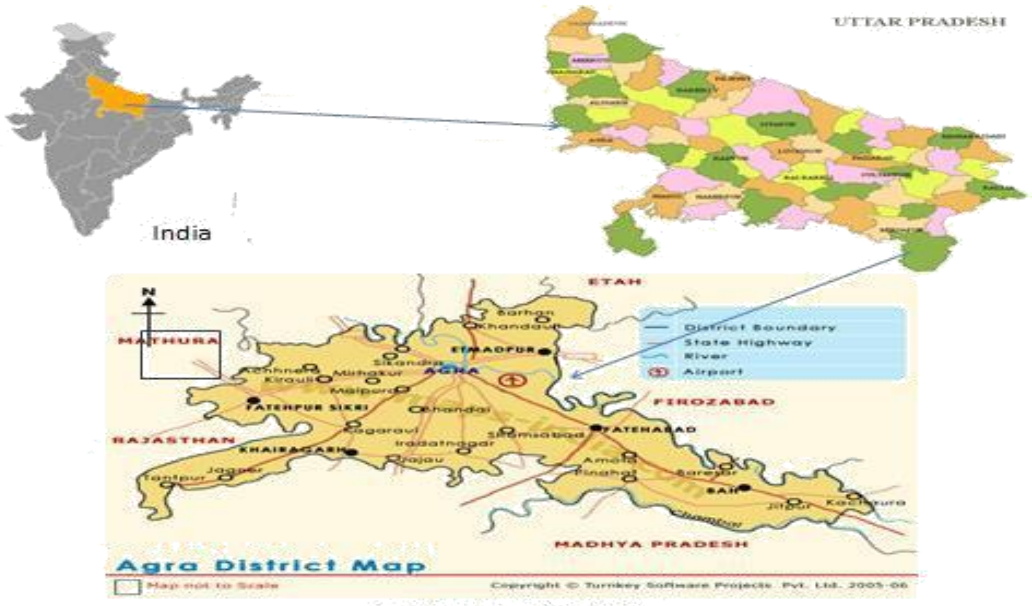
1. Identification of plant species used as veterinary galactagogue for domestic animals in Uttar Pradesh:

A Literature survey of ethno veterinary practice in Uttar Pradesh will be conducted to identify herbal galactagogue used by the various communities documented in available databases like-Science Direct, PubMed, Scopus, Web of Science, Google Scholar, Dissertations, Theses, Books, and Technical reports etc.

2. Identification of plant species used as veterinary galactagogue for domestic animals and related folk claims among the farmers of Agra district:

2.1 Study Area:

District Agra is situated in Western Uttar Pradesh between geographical limits 27.11′ degree Latitude North and 78.0′ degree to 78.2′ degree Longitude East, in 4027 Km^2 area at an elevation of about 171M above sea level. According to census 2011, Total urban/metropolitan and rural population of Agra was 1760285 and 2394602 respectively. District Agra is bounded by districts Mathura (North),Firozabad (East), Dholpur of Rajasthan state (South) and Bharatpur of Rajasthan state on the (West). Agra is situated on the bank of Yamuna River and River Chambal in North (About 55 Km) makes the natural boundary of the (district). (https://agra.nic.in) excessed on 15/05/2020



Location map of study site

2.2 Collection of medicinal plants and associated traditional knowledge:

The study will be based on extensive and intensive periodical excursions of different localities of Agra district in order to collect voucher specimen and related folk-claims regarding uses of medicinal plants as galactagogue. The primary data will be collected through personal communication with farmers of Agra district engaged in animal husbandry. Prior to survey, a questionnaire will be designed and pre-tested with five informants to find out its suitability for present study and will be modified according to the responses of informants if feel necessary.

The revised questionnaire will be used for gathering data about medicinal plants used as ethno veterinary galactagogue in the study area. Pre informed consent will be obtained from the resource persons before interview. The method used by Kumar *et al.,* 2012 will be used for present study.

2.3 Preservation of voucher specimen:

Voucher specimen of medicinal plants will be collected and preserved in the form of herbarium specimen following standard method (Jain and Rao, 1978) and deposited in the Department of Botany, Dayalbagh Educational Institute, Agra for future reference.

2.4 Identification of collected and preserved specimens and nomenclature:

Identification of collected and preserved specimens will be done with the help of various floras and literatures and by comparing with the specimens collected herbaria. The Identity of medicinal plants will also be confirmed by Taxonomist.

2.5 Citation and Nomenclature:

Citation and Nomenclature of the plants will be updated according to International Plant Name Index (http://www.ipni.org)

2.6 Data quantification and analysis:

The quantitative ethno botanical techniques have great significance as they provide relative importance of plant species to the ethnic group, preference information on different species and may also aid in the conservation of biodiversity. The collected data will be analyzed on the basis of following parameters

2.6.1 Relative frequency of citation (RFC):

The popular etnoveterinary galactagogue among farmers will be identified by citation-frequency. Logically, popular medicine received very high citations; it will be calculated by the following formula (Kumar *et al.*, 2012):

$$\text{Frequency of citation (\%)} = \frac{\text{Number of informants who cited the species}}{\text{Total number of informants interviewed}} \text{x}100$$

$$\text{Relative frequency of citation RFC (\%)} = \frac{\text{Frequency of citation for particular species}}{\sum \text{Frequency of citation of all species}} \text{x}100$$

2.6.2. Informant consensus factor (Fic):

In ethnobotanical studies, consensus analysis provides a measure of reliability for any given claim providing reliable evidence. For this purpose the informant consensus factor (Fic) will be employed to determine the consensus between the informants for specific use category.

It will be calculated as the number of mentions in each usage category (nur) minus the number of taxa used in each category (nt), divided by number of mentions in each usage category minus one. The Fic values will range between 0 and 1:

$$\text{F}_{\text{IC}} = \frac{\text{N}_{\text{UR}} - \text{N}_{\text{TAXA}}}{(\text{N}_{\text{UR}} - 1)}$$

Where = Factor of informants consensus, = number of use report in a particular illness category and = number of taxa used to treat that particular category by informants (Trotter and Logan, 1986).

2.6.3. Use value (UVis):

The user value provides information on the relative usefulness of the plants to the cultural group/community (Kumar and Bharati, 2013), it will be calculated as follows:

$$\text{UV}_{is} = \frac{\sum \text{UV}_{is}}{\text{n}_{is}}$$

Where U*is* equals the number of uses mentioned in each event by informant (*i*) and n_{is} is number of events for species (*s*) with informants (*i*). The n_{is} varies with day to day work even a single person is counted more than one individual. In some case, informants give information in

instalments, then, each instalment is counted as separate event and $\sum U_{is}$ was separately counted (Martin, 2008).

2.6.4. Fidelity Level (FL):

Fidelity level helps in identification of species according to their relative effectiveness (Ugulu and Baslar, 2010); it is calculated as follows:

$$FL = \frac{I_p \times 100}{I_u}$$

Where Ip refers to the number of informants who independently suggested the use of a species for same major purpose and Iu refers to total number of informants who mentioned the plant for the treatment of any given disease (Singh *et. al*, 2018).

2.7. Description:

The identified plant species and related traditional knowledge will be described in detail for documentation.

3. Development of poly-herbal galactagogue formulations:

Development of poly-herbal galactagogue formulations for domestic animals will be done with the help of combination of locally available medicinal plants identified on the basis of literature and field survey in various ratios.

4. Effect of poly herbal galactagogue formulations on milk yield:

Study will be conducted in the R.S.S. Gaushala, Dayalbagh on Sahiwal × Holstein-Friesian crossbreed cows. 45 healthy cows of approximately same age group and weight at various lactating stages i.e. early, mid and late (15 cows in each stage) will be used for the present study. These cows will be divided into three groups having five cows from every lactating stage (total 15 cows in every group) and feed standard seasonally available roughages and concentrates to meet their nutritional requirements as offered to the rest of the herds in Gaushala.

One group of the animal will be given appropriate amount commercial galactagogue available in local market along with daily feed. The cows in the second group will be given of poly-herbal

galactagogue formulation along with feed and the cows in the third group will not be given any commercial or developed herbal galactagogue formulation and will act as control.

T1 Commercial galactagogue available in local market

T2 Developed poly-herbal galactagogue

T3 Control (No galactagogue)

Daily milk yield of each animal will be recorded and data will be spared in XLS worksheet to calculate average milk yield and difference in milk production at every lactating stage in control and treated group of animals

5. Effect of poly herbal galactagogue formulations on milk quality:

The effect of poly herbal formulation on quality of milk will be analyzed according to FSSAI, 2016 and IDF, 2002 standards for the following parameters

5.1. Platform test and sensory evaluation of raw milk:

Platform test and sensory evaluation of raw milk is very important for milk quality evaluation (Schiano*et al.,* 2017) so, these tests will be performed for parameters like general appearance, color, taste (sweet, sour or salty), odor (pleasant, no pleasant, volatile aromas) and texture (soft, smooth, rough) etc. with the help of experts at Dairy Technology Division, Dayalbagh Educational Institute, Agra.

5.2. Physical properties

Physical properties of the milk like titrable acidity (as lactic acid), pH value, specific gravity and total solids will be analyzed by titration method, pH meter, Lactometer and gravimetric methods respectively.

5.3. Fat content

Fat content will be determined by Rose-Gottlieb Method as described in FSSAI manual 2016. Fat content will be calculated by the following formula

$$\text{Fat content } (\%) = \frac{\text{Weight of extracted fat}}{\text{Weight of milk}} \text{x}100$$

5.4. Lactose

Lactose content in milk will be analyzed by High-Performance Liquid Chromatography (HPLC) method as described in FSSAI Manual 2016.

5.5. Protein

Protein content in milk will be determined using IDF procedure as described in FSSAI Manual 2016.

5.6. Urea

Protein content in milk will be determined using IDF procedure as described in FSSAI Manual 2016.

6. Toxicity evaluation of milk produced after giving polyherbalglactagogue formulations:

Milk samples will be analyzed through outsourcing by any reputed and certified laboratory for the presence of any residual toxic substance.

DELIBERABLES

The study may result new poly-herbal galactagogue formulation which may be useful for increased lactation with high quality milk in domestic animals.

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